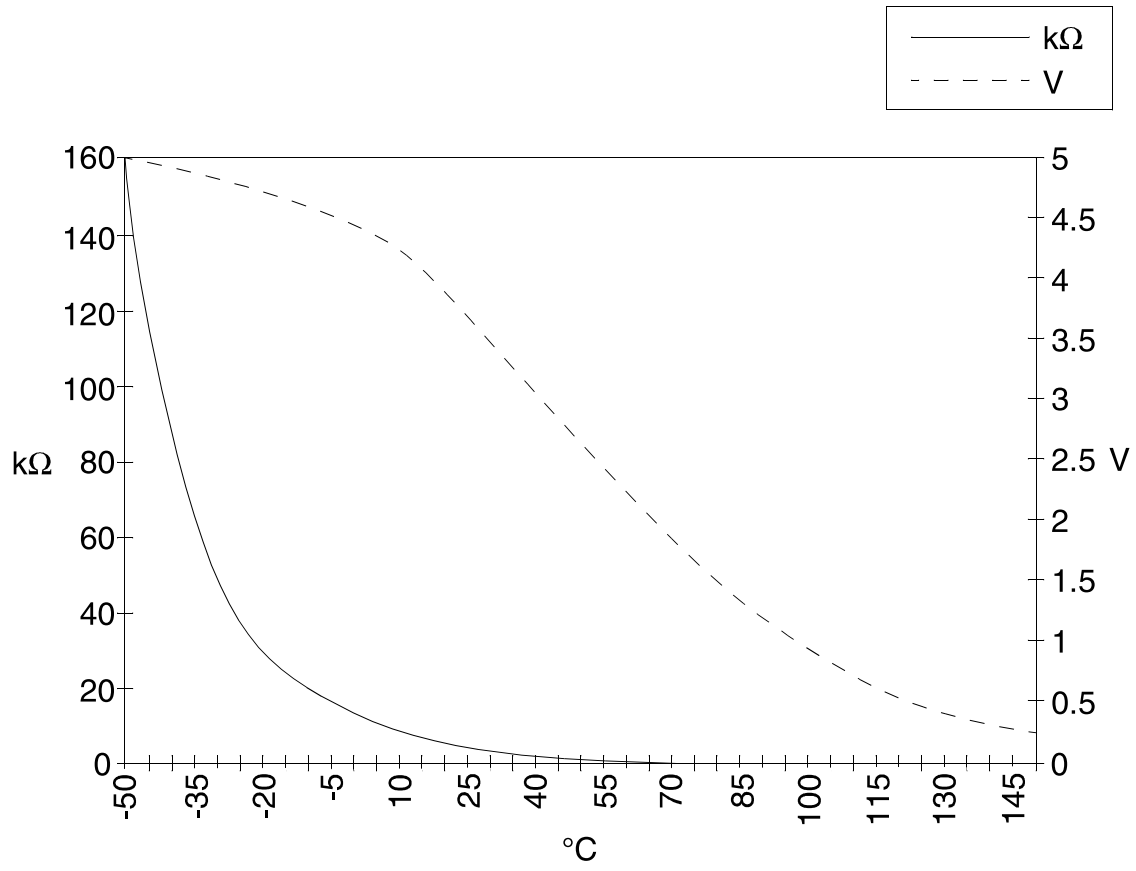
For NAS vehicles with secondary air injection, the signal from the ECT sensor is monitored at engine start, to determine whether the conditions are cold enough to warrant secondary air injection to be employed. The ECT sensor is then monitored to switch off the secondary air injection when the required engine coolant temperature has been attained.

☞ **EMISSION CONTROL - V8, DESCRIPTION AND OPERATION, Secondary air injection system.**

The ECT works as a Negative Temperature Coefficient (NTC) sensor. As temperature rises, the resistance in the sensor decreases, as temperature decreases, the resistance in the sensor increases. The ECT sensor forms part of a voltage divider chain with a pull up resistor within the ECM. Consequently as the ECT sensor resistance changes, the analogue voltage at the input signal from the ECT sensor to the ECM will be adjusted which corresponds to the temperature of the engine coolant. With this information, the ECM can implement the correct strategies for cold start, warm up etc. The ECM supplies the instrument cluster with a pulse width modulated (PWM) coolant temperature signal to drive the temperature gauge.

Input/Output

The electrical input and output to and from the ECT sensor are reference voltage and sensor earth. The ECM provides the ECT sensor with a 5 volt reference via pin 22 of connector C0636 of the ECM, and earth via pin 21 of connector C0636 of the ECM. The normal operating parameters of the ECT sensor are as follows



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Should the sensor fail the ECM has a back up strategy that uses a changing default value during warm up based on the signal from the inlet air temperature sensor. When the strategy default value reaches 60 °C (140 °F), the ECM implements a fixed default value of 85 °C (185 °F). It will also illuminate the MIL.

The ECT sensor can fail the following ways or supply incorrect signal:

- Sensor open circuit.
- Short circuit to vehicle supply.
- Short circuit to earth.
- Incorrect mechanical fitting.
- Signal fixed above 40 °C (140 °F) will not be detected.
- Signal fixed below 40 °C (140 °F) will be detected.

In the event of an ECT sensor signal failure any of the following symptoms may be observed:

- Difficult cold start.
- Difficult hot start.
- Driveability concern.
- MIL illuminated.
- Instrument cluster temperature warning lamp illuminated.
- Temperature gauge reads excessively hot.
- Temperature gauge reads excessively cold.
- Cooling fan will not run.

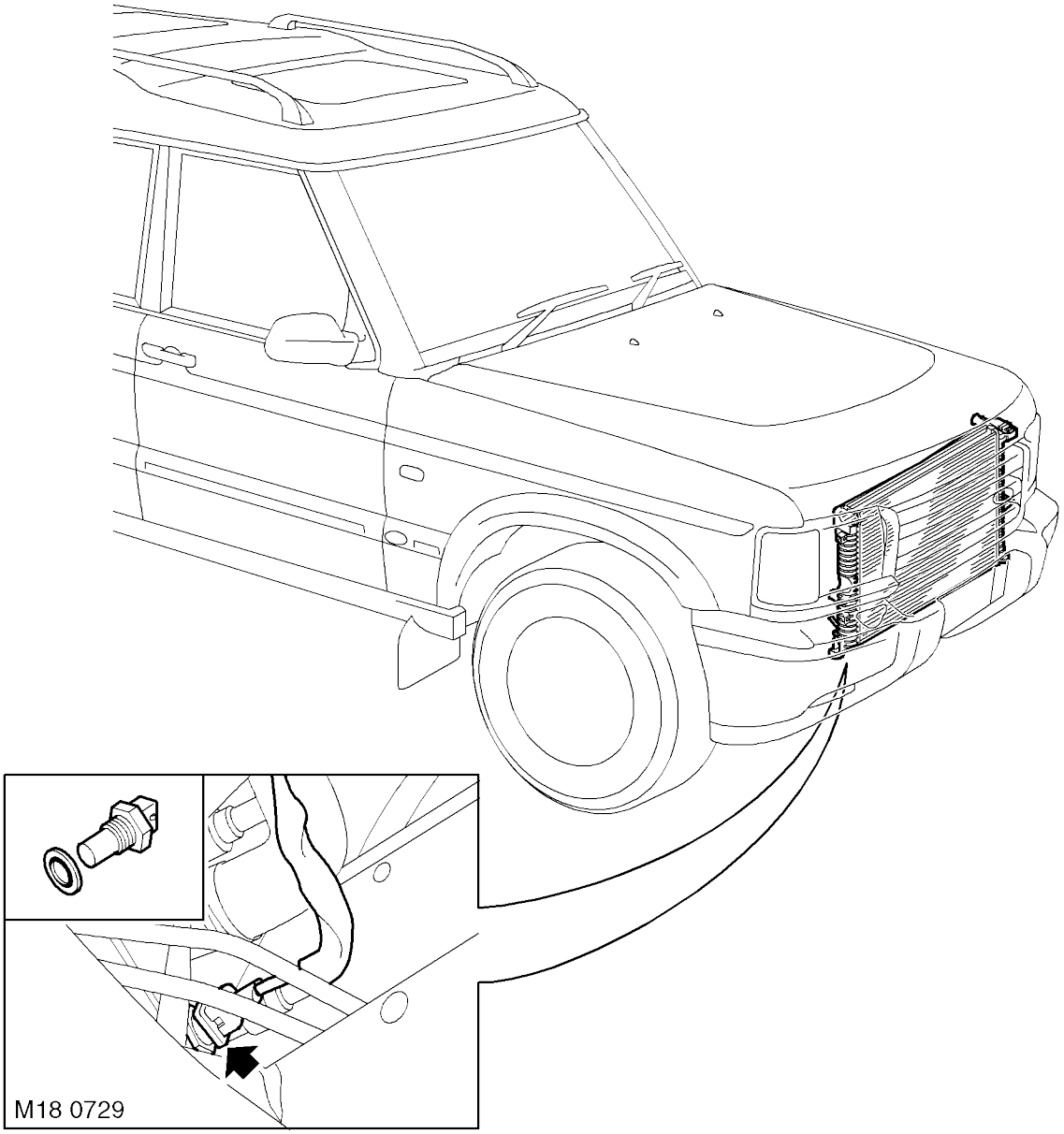
There are three types of ECT sensor diagnostic checks:

- The ECT sensor signal is within limits, but is inaccurate – the engine has to be running and the signal indicates a coolant temperature below 40°C (104°F). The signal differs too much from the coolant temperature model for longer than 2.53 seconds.
- The ECT sensor signal is greater than the maximum threshold value – the ECM has to be powered up to perform the diagnostic, but the engine does not need to be running.
- The ECT sensor signal is less than the minimum threshold value – the ECM has to be powered up to perform the diagnostic, but the engine does not need to be running.

Should a malfunction of the component occur the following fault codes may be evident and can be retrieved by TestBook:

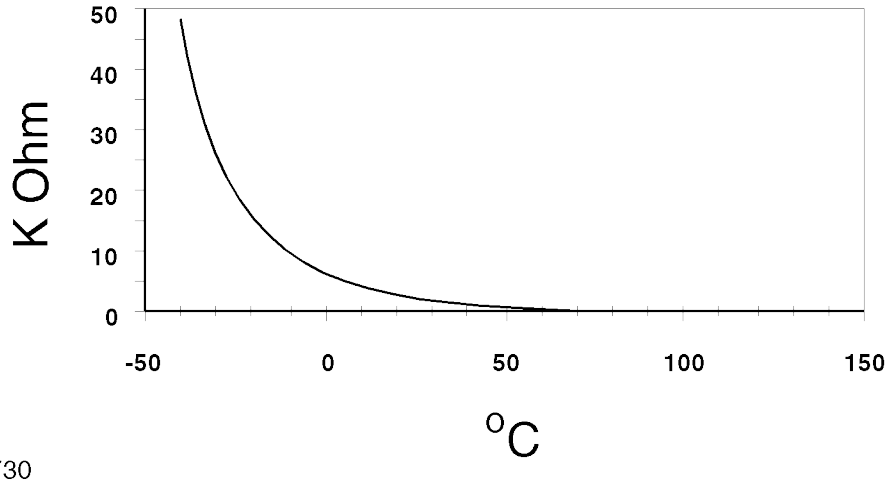
P code	J2012 description	Land Rover description
P0116	Engine coolant temperature circuit/range performance problem	Signal differs too much from temperature model for longer than 2.53s
P0117	Engine coolant temperature circuit low input	Open circuit or short circuit to battery supply
P0118	Engine coolant temperature circuit high input	Short circuit to earth

Thermostat Monitoring sensor



The thermostat monitoring sensor is located in the radiator, adjacent the bottom hose. The ECM compares the temperature measured by the thermostat monitoring sensor to the temperature measured by the ECT sensor. If the difference between the two readings is too great, the ECM determines the thermostat is stuck. In this case, the ECM registers a fault code in its memory.

The thermostat monitoring sensor works as a Negative Temperature Coefficient (NTC) sensor. As temperature rises, the resistance in the sensor decreases, as temperature decreases, the resistance in the sensor increases. With this information, the ECM is able to monitor the performance of the thermostat. The normal operating parameters of the thermostat monitoring sensor are as follows:



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Input/Output

The ECM provides the thermostat monitoring sensor with a 5 volt reference via pin 21 of connector C0635 of the ECM, and an earth via pin 5 of connector C0635 of the ECM.

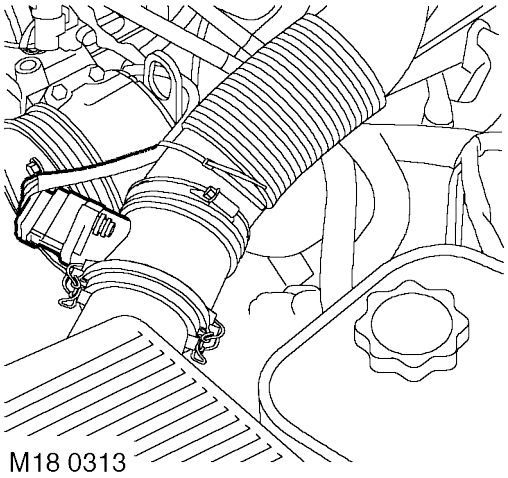
There are three types of thermostat monitoring sensor diagnostic checks:

- Sensor signal is above maximum threshold. For the ECM to register this as a fault, and illuminate the MIL, the temperature registered by the thermostat monitoring sensor must be above 140 °C (284 °F) for more than 1 second.
- Sensor signal is below minimum threshold. For the ECM to register this as a fault, and illuminate the MIL, the temperature registered by the thermostat monitoring sensor must be below -33 °C (-27 °F) for more than 1 second, while the inlet air temperature reading is greater than -32 °C (-25 °F).
- Signal difference between ECT sensor and thermostat monitoring sensor is below maximum threshold. For the ECM to register this as a fault, and illuminate the MIL, the following conditions must exist:
  - No maximum or minimum threshold signal faults exist.
  - No faults are recorded against the thermostat monitoring sensor or vehicle speed signal.
  - Engine not in idle speed control.
  - Fuel cut-off not active.
  - Engine speed is greater than 400 rpm.
  - Road speed is greater than 0 mph.
  - Integrated mass air flow from engine start to fuel cut-off is greater than set value (between 3 kg and 10 kg dependent upon engine coolant temperature at engine start).
  - Engine coolant temperature at engine start is between 9 °C and 39 °C (48 °F and 102 °F).
  - High range is selected.
  - Delay time before thermostat monitoring is enabled is between set limits (between 50 and 500 seconds dependent upon engine coolant temperature at engine start).
  - Engine coolant temperature is greater than 90 °C (194 °F).
  - The difference between the ECT sensor reading and the thermostat monitoring sensor reading is less than 39 °C (102 °F).

Should a malfunction occur, the following fault codes may be evident and can be retrieved by TestBook:

P code	J2012 description	Land Rover description
P1117	Radiator outlet temperature thermister low	Thermostat reading below -33 °C (-27 °F)
P1118	Radiator outlet temperature thermister high	Thermostat reading above 140 °C (284 °F)
P0126	Engine thermostat defective	Difference in radiator and engine coolant temperatures too small

Mass Air Flow (MAF)/ Inlet Air Temperature (IAT) sensor (C0149)



The MAF/ IAT sensors are combined into a single unit and located between the air filter housing and the inlet manifold. The ECM receives input signals from the MAF/ IAT sensor to calculate the mass of air flowing into the engine inlet manifold.

Input/Output

The MAF sensor has both electrical input and output. Input to the MAF sensor comes from two different sources. Battery voltage is supplied to the MAF sensor via fuse 2 of the engine compartment fuse box. The MAF sensor also utilises a 5 volt reference input via pin 7 of connector C0636 of the ECM. The MAF sensor output voltage is measured via pin 23 of connector C0636 of the ECM.

The IAT sensor has only electrical output. Output from the IAT sensor is measured at pin 34 of connector C0636 of the ECM, this is a variable voltage/ resistance measured by the sensor to provide air temperature information to the ECM.

The MAF/ IAT sensor share the same sensor earth. Sensor earth is via pin 9 of connector C0636 of the ECM.

The MAF/ IAT sensor and its connector has silver plated terminals for its low current signals to protect against corrosion. **DO NOT** apply 12V to the 5V supply, as this will destroy the internal circuitry. The MAF/IAT sensor should not be dropped or roughly handled and should be kept free from contamination.